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# **Supplier evaluation process within a self organized logistic network**

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## **Supplier evaluation process within a self organized logistic network**

### **Biography of the authors:**

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## **Supplier evaluation process within a self organized logistic network**

### **Abstract:**

Over the past years the relationships between industrial companies have dramatically evolved, the objective being the improvement of the internal management of each of the partner companies and of their global performance in meeting the requirements of the customers. The control of the relationship between partner companies concerns all the actions they develop together to achieve their common objectives and to react at the right time to any failure of one of the partners. A negotiation between the partners is thus required, and this approach involves the management and organization of each partner's production. The client companies will have to optimize at the same time both their production and their relationships with their suppliers. The suppliers will have to position themselves in reply to the calls for proposals emitted by client companies and demonstrate their capacity to support these companies while using their own assets.

This paper aims at improving the control of the customer - supplier relationship by proposing an organization of all the partners called "self organized logistic network". In this network, each supplier can evaluate his performance using a multicriteria decision aid method. The objective of the suppliers evaluation process is threefold to select the reliable supplier who delivers low-cost products or services that meet the customers' requirements, to ensure that the suppliers with whom the company operates are reliable and satisfy the needs of the client company in terms of quality, quantity, delivery times, etc, and also to dynamically monitor the relationship between the supplier and the customer.

## 1. Introduction

The ultimate goal of a company is to ensure its durability by achieving a sufficient profit margin that will allow it to invest and innovate. It must control the supply and demand in the economic system to which it belongs. The company is in relation with suppliers and customers, and thus the logistics of the company must be understood as the optimization between the upstream suppliers and the downstream customers. The goals of the logistic management are many and on different levels. The most important of them are the following: (1) controlling the logistic costs, which is related to a traditional search for performance but which allows the elaboration of a real price and margin policy; (2) guaranteeing the reliability of the services offered to the partners (whether they are customers or suppliers of products and/or services), this reliability being applied to the delays, the transport of products (regarding quantity as well as quality), the prices notified and the costs induced (especially by any possible un-quality), as well as to the associated administrative documents, all of which requires an approach of total quality (Total Quality Management)<sup>2</sup>; (3) maintaining the responsiveness of the company through its logistics, which ranges from the simple reaction to a commercial demand to a more global capacity of adaptation to markets, in a logic of time-based management [1] or of time-to-market [2].

The customer - supplier relationships<sup>3</sup> are thus as essential to a company as its internal relationships. A new approach of the relationships between companies is needed. It will be called "industrial partnership", in which the companies are part of a network. In this new context, the companies require new modes of organization and operation, which refer to the notions of flow, supply chain, networks, circulation of services and information. The contribution and participation of each of the partners are thus fundamental to make the Supply Chain Management (SCM) a successful project.

The control system of each actor partner must thus be adaptive enough to satisfy the requirements of production and to manage the possible risks. We proposed an organization of all the partners called "Self organized logistic network" in order to improve the control of customer-supplier relationship. In this organization, the decision system manages the operation of a group of actors who are in a partnership, that is who are part of a network of companies. In this network, each supplier can evaluate his performance using a multicriteria decision aid method. The objectives of the supplier evaluation process is to select the reliable supplier who delivers low-cost products or services that meet the requirements of the customers, to ensure that the suppliers with whom the company operates are reliable and satisfy the needs dictated in terms of quality, quantity, and of delays, etc, and to dynamically monitor the relationship between the supplier and the customer. We preset in this paper the choice of this logistic network and we present how the evaluation of the suppliers can be done using a multicriteria decision aid method. Finally conclusion is given.

## 2. Definition of Logistic / Supply chain

We will define the existing organizations on which we have based our study to propose the "self organized logistic network" allowing the improvement of the control of customer-suppliers relationship.

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<sup>2</sup> Total quality management involves a number of management methods whose aim is to ensure that all the activities associated to the logistic process contribute to high and predetermined quality levels. Initially developed in the field of industrial production, this approach is now applied to all the physical and administrative procedures of a company, or even of a network of companies.

<sup>3</sup> We can find in [3] a model which can be used to determine whether a partnership is warranted, and if so, how close of a partnership is warranted.

Under the pressure of globalization, competition, reduced cycle times and increasing complexity, companies are in search of new forms of organization, in particular to meet the increasing needs for responsiveness. Today, the customer is placed at the center of the organization. This is a long-term job, which requires not only the implementation of new customer-oriented processes, but also a modification of the mentalities. This is part of what is called "supply chain management". [4] discuss how the change logistics organizations are viewed within various ideologies. They conclude that there is a need for improved ability to deal with change within logistics organizations, and that this can be achieved by adopting new theoretical and practical perspectives into the established ideologies of these organizations.

The term logistics was first used by the military in the middle of the 19th century, and referred to the art of combining all the means of transportation, catering and quartering for the troops. It was then used for economic purposes. Logistics is seen as a global approach of the problems of organization and management of the operations of transport, handling and storage allowing the flow of goods generated by the activities of a company [5]. It was first the flows of products that attracted the attention of logisticians, then the information systems.

In the early 90s, logistics reached maturity and became a technology of control of the flows of information and products. The information flows took precedence over the product flows and it is not a coincidence if the development of the logistic approach is linked to the development of computing [6]. Indeed, the technologies have evolved so much, so the flow of information becomes a flow between companies and not within companies. It is the real factor of evolution between logistic and supply chain. One of the first definitions of the supply chain was given by Lee and Cohen in 1988. They defined it as a network of companies that ensures the procurement in raw materials, their transformation into components and then in finished products, the storage of the finished products and finally their distribution to customers. A supply chain can be defined as an integrated process in which a number of different entities (suppliers, manufacturers, distributors or retailers) work together, to transform raw materials into specific final products. The chain is traditionally characterized (Cf. Figure 1) by an upstream flow of raw materials and a downstream flow of information [7].

### ***PLACE FIGURE 1 HERE***

The great interest of the concept of supply chain is that it makes each entity aware of its role in a larger flow. [10] provide strategic and operational descriptions of the eight supply chain processes identified by members of The Global Supply Chain Forum. The aim was to provide managers with a framework to be used in implementing supply chain management. Although the definition of the supply chain is concerns the running of one company, it can easily be used in the context of a network of companies as well as for an extended or virtual company. Companies are induced to go beyond their own boundaries and consider now their economic associates as being members of the same organization. Company managers are forced to redefine their strategic positions in a competitive, uncertain and constantly changing environment. It seems then that a new form of organization is appearing: the network, which means grouping, cooperation, and alliance between two or several partners who want to improve their respective performances and acquire a decisive advantage over the competition. The network can be defined as a contractual organized and articulated set of at least two partners who are linked together by short or long term exchange relationships and by the sense of belonging to a collective entity. In 1986, Thorelli, interested in the phenomena related to company networks, proposed a very general definition: A situation in which two or several organizations are involved in long-term relationships. The existence of the network allows a gathering of productive resources. A set of means and of principles enabling the actors to establish relationships that generate values. We present in figure 2 the example of a

network composed of a set of nodes and arcs [12] [13] [14]. The nodes represent the industrial units that can carry out tasks and the arcs represent the relationships and flows between the nodes. A network will be built each time an order is to be processed.

### ***PLACE FIGURE 2 HERE***

A new form of cooperative organization, characterized for the most part by the management of the partners, called "logistic network", has been introduced to serve the final customer as well as possible. As it was defined above, a logistic network is a network of interdependent groups, which have in common the will to find the most efficient means to achieve their goal, which is to satisfy the consumer. This type of network is built on the partnership. The partnership is the catalyst that creates the logistic network and makes it work, but only after all the actors have reached a level of confidence in their partners higher than the one existing in the standard relationships as we know them today. It is in a sense an optimized logistic network [15]. Here, the logistics people would change their ways of working and would get involved in a permanent progress approach, made of continuous improvement aimed at maximizing the economic potential. To make the best possible use of an analysis of the supply chain, it is necessary to reconsider and reconstruct the modes of interaction between all the actors of this chain. The traditional methods must be studied in order to use their advantages within the frame of a whole company network. It is indeed more productive to use the resources of all the network members. Companies linked together combine their forces to identify their interactions and to form a system that is as efficient as possible. The economies that result from this are shared between all the members of the network, including the final consumer. With this notion of logistic network, we enter the era "of Industrial Internet" which forces companies to develop new types of relationships with the suppliers on the one hand and the consumers on the other hand. The development of logistic management software and that of communication channels is not possible today without the Internet [16].

### **3. Self organized logistic network**

We can say that, in the past the enterprises had a great number of suppliers so that they could compare them and negotiate the best offer. This new competitive environment forces companies to manage their sources of procurement differently. It becomes impossible to manufacture innovative good-quality low-cost products without a tight collaboration with a network of effective and reliable suppliers [17] [18] [19].

In order to improve the customer-supplier relationship we have introduced the self organized logistic network: *it is a logistic network in which the organization of the flows results from the direct coordination and cooperation relationships existing between the suppliers*. It is an organization characterized by the management of the partners. Coordination of the decisions is obtained through cooperation, which is based on a negotiation between all the potential partners towards a common objective. These decisions are based on an increase of the autonomy of the partners and on their capacity to communicate with one another, so as to be more reactive. We consider self organization as a mode of decision-making in real time without any preliminary estimated organization [20]. The general principle of order assignment is based on a mechanism of search for the best response to a call for proposal diffused beforehand. The customer launches a call for proposal to all his suppliers, either in the case of a normal situation of supplying or subcontracting of the goods or services, or in the case of internal or external disturbance. The suppliers then begin to negotiate with one another (Cf. Figure 3). The solution which appears to be the most efficient with regard to the evaluation criteria will be adopted.

### ***PLACE FIGURE 3 HERE***

We will present in the next section how the "best" solution can be obtained based on a multicriteria decision aid method allowing the evaluation of the performance of the suppliers. Before that, we present the typology of performance in order to position our work.

The evolution of the relationships between companies has thus become the focus of industrial concern, to achieve a better performance, a better internal management of each partner and a better satisfaction of the customer. The management of the performance is increasingly defined with regard to the notion of customer service quality that gives a sense to the actions and to the decisions. In the perspective of reduced costs and customer satisfaction concerning delays, a search for industrial performances must be undertaken not only at the level of each firm, but also at the level of the logistic network. We can thus clearly identify two types of performance: a global performance that refers to a group of companies and a local performance that refers to each partner company.

#### **4. Typology of the Performance**

Since the beginning of the industrial area, any action carried out within an enterprise, at any level and whatever its nature has been justified by a desire of performance. Being the best, satisfying the customers, beating the competition, becoming wealthy, etc., these are the factors taken into account when judging the success of a company. We are going to see now which type of performance we have to take into account for the evaluation of the suppliers.

##### ***4.1. Global Performance***

The competition between companies is no longer direct, but occurs rather through the various logistic networks to which they belong. An increasing amount of research is focusing on the improvement of the global performance of the production and distribution networks within the frame of supply chain management. The evolution of the organization models, of the economic context and of the industrial strategies of a network lead each partner in this network to control their performance through a global approach, which induces a systematic and multicriteria vision of the global performance concept. The efficacy<sup>4</sup> of a company is appreciated through its success and competitiveness, while its efficiency<sup>5</sup> is appreciated through its productivity, costs, output and profitability [21]. In a performance study of logistic networks, two types of indicator were defined [22]. The objective indicator concerns the volume of the exchanges between partners, while the subjective indicator corresponds to the satisfaction of both partners. The performance of the network can thus be measured by its capacity to reduce logistic costs, to improve the quality of services and to optimize the management of flow circulation in the network. By establishing a history of the network production over the last years, it can also be possible to determine the global reliability of a logistic network and to determine whether the firm is likely to respect delays [14].

##### ***4.2. Local Performance (Internal/External)***

In the present economic situation, the network strategy seems to be the most able to satisfy the requirements of the customers. The local indicators represent the individual performances of each partner. Nine criteria were proposed for the categorization of the suppliers [23]: quality

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<sup>4</sup> Efficacy is defined as the capacity of an organization to reach its fixed objectives.

<sup>5</sup> Efficiency is the best ratio between the degree of customer satisfaction and the means used to obtain it.



and reliability, costs, product performance, innovation, production, logistics, agility, after-sales service, and strategic aspects. But it should be noted that this set of criteria is not clearly defined, which means that they can be arbitrarily and variously measured. Indeed, we have noticed that these performances are not explicitly formalized in term of criteria or indicators. We will attempt to define a formalization of the criteria we have selected for supplier evaluation. In a study of the customer-supplier relationships, [24] explained that the local performances have an impact on the global performance of a network. In our work we wish to quantify the local evaluation of each supplier, in view of improving the global performance of the logistic network. These exchange relationships illustrate the notions of internal and external indicators. The external indicators involve the judgment of the customer on the product (service) that he receives (for example the time needed to take an order, the quality of the product, etc...), and also the judgment of the upstream supplier (for example the number of returns, the speed at which invoices are paid). The internal indicators are essentially used to measure and to follow what happen inside the company (productivity, quality of the products, ...) (Cf. Figure 4). . It is obvious that internal and external performances do not exist independently of each other [25]. A good internal performance is essential to the external performance.

#### ***PLACE FIGURE 4 HERE***

In the supplier evaluation process, we have to work with external indicators. The performance obtained will thus be local because it relates to a member of the network, in the optics to improve the global performance of the logistic network.

### **5. Choice of a multicriteria decision aid method**

Traditionally, the selection and the evaluation of the suppliers were made using a single criterion: the cost of the product. The order was assigned to the supplier who had proposed the cheapest and best bidding [23]. Today, the selection of the supplier is made using a multicriteria analysis and involves more than one person [26]. The explicit consideration of multiple conflicting objectives in a decision model has made the area of Multiple Criteria Decision-Making (MCDM) very challenging [27]. The multicriteria decision aid aims to provide a decision-maker with tools allowing him to progress in the resolution of a decision problem where several and often conflicting points of view have to be taken into account. The exploitation of multicriteria methods allows the integration a number of constraints. It will help to find the solution which seems to be the best. Several approaches have been developed in order to find a solution for industrial problems: [28] detailed the integration of the multicriteria approach in various industrial functions, [29] and [30] dealt with the problem of multicriteria scheduling, [31] gave a great number of industrial examples. A multicriteria algorithm aims at selecting one or several solutions from a number of possible solutions by using a set of criteria to estimate relative preferences. The decision-making using multicriteria algorithms was developed by [32], [33] [31] [34] [35] [36]. These works were based on the concepts presented by B. Roy and D. Bouyssou.

A survey of the state of the art of the multicriteria decision aid methods [37], [38] has led us to select a method called AHP (Analytic Hierarchy Process) presented by T.L. Saaty in the 70s [39]. AHP has advantages over the other decision-making approaches [40] [41]: (1) it is able to handle both tangible and intangible attributes; (2) it is able to structure the problems hierarchically to gain insights into the decision-making process; (3) it is able to monitor the consistency of the judgments of a decision maker.

### ***5.1. Presentation of the 'Analytic Hierarchy Process' method***

AHP is a powerful and flexible tool of decision-making for complex multicriteria problems whose qualitative and quantitative aspects must be taken into account. This method helps the decision-makers to structure the significant components of a problem in a hierarchical tree-like structure. Then, the results are synthesized by decomposing complex decisions into a series of simple comparisons and arrangements. Thus, AHP is a decision-making process that directly interprets the data by forming judgments which are considered through a scale of measurement inside a hierarchical structure.

The Analytic Hierarchy Process involves four distinct steps:

Step One (setup): Decision making criteria are generated. Hierarchical relationships are established between the criteria and are then represented in the form of a matrix.

Step Two (weighing): The matrices are filled with criteria comparisons. The comparisons allow the calculation of the criteria weighing vector.

Step Three (ranking): The different problem solutions are ranked on their ability to satisfy the various criteria.

Step Four (evaluation): The final solution ratings are then calculated using the rankings determined in step three and the weighing vector calculated in step two.

This process organizes a hierarchical decision-making problem in a mathematically rigorous manner to ensure proper results of the decision-making process. It separates the decision-making process into stages to enable the team working on the problem to focus successively on each step needed to make a decision.

The hierarchy of the decision-making process is defined by a quadruplet  $\langle N_1, N_2, N_3, N_4 \rangle$  (Cf. Figure 5) where:

$N_1$  = Global Objective;

$N_2$  = Criterion Level;

$N_3$  = Indicator Level;

$N_4$  = Alternative Level.

The authors consider the following notations:

$Cr_i$  = set of criteria;

$I_k$  = set of indicators of the  $Cr_i$  criterion;

### ***PLACE FIGURE 5 HERE***

Once the hierarchical structure of the decision problem is built, the question is: how is the factor of a higher level influenced by the factors located at the lower level? Since the influence of the low-level factors is not uniform, it is therefore necessary to identify their intensities (priorities). The determination of the priorities of the low-level factors with regard to the global objective can be decomposed into a sequence of priority problems, one for each level, and each problem can be related to a sequence of pair-wise comparisons. These comparisons are the central 'ingredient' of the AHP method. A pair-wise comparison assesses the relative importance of two elements of a same level with respect to the operator (decision maker) contributing to reaching the objective of the adjacent higher level. For that, in the case of a qualitative comparison, it is necessary to choose a scale of values to specify the degree of importance (weight, priority) of an element with regard to another. We adopted the scale of value (1-9) used in the AHP method [39]. He defines numerical values (1 to 9) corresponding to the importance of a factor with regard to another factor (Cf. Table 1).

## ***PLACE TABLE 1 HERE***

The pair-wise comparison being carried out, it is necessary to seek a vector of priority that classifies the alternatives in ascending or decreasing order. The classification by priority of the elements of the hierarchy level contributing to reaching an objective of the adjacent higher level is called 'relative weight' or 'order of priority'. T.L. Saaty proposed an eigenvector approach to estimate the weights starting from the pair-wise comparison matrix. The eigenvector obtained represents the order of priority sought, i.e. the relative weight of the sub-elements. We can note that two significant concepts are to be distinguished: the pair-wise comparison which allows us to obtain the relative importance of an element with regard to another (on a same level) and the vector of priority or weight (vector of relative importance), which expresses the relative arrangement of the elements of a level with regard to each element of the higher adjacent level. The question now is: how to go up to the first level (level 1: global objective)? In other words, how to classify the alternatives (level 4) by order of priority with the aim of achieving the global objective (Og)? The aggregation principle consists in carrying out matrix multiplications. The final result is a vector of rating of the alternatives considered. It gives the relative importance of the alternatives with regard to the global objective (Og). And then, for the best alternative, the supplier performance is determined.

### ***5.2. Advantages of using AHP for the evaluation of the suppliers***

The Analytic Hierarchic Process is a suitable method to solve the problem of supplier evaluation. It can be used to determine both the importance of the weights for the criteria and the relative ranking of the alternative potential suppliers. The strength of the method lies in its ability to handle the judgmental factors [42]. AHP, when applied to the supplier evaluation problem, accomplishes the following: (1) it provides a systematic approach that focuses on commonly used evaluation criteria, such as the respect for delays, costs, and quality etc., AHP makes it easier for suppliers to quantify their subjective evaluations. (2) By using a step-by-step approach to quantification, the difficult task of processing the information about suppliers is simplified. (3) The determination of the criterion weights and of the supplier ratings and rankings is accomplished in one integrated procedure.

In order to apply AHP to the supplier evaluation problem, it is necessary to elaborate and then to formalize the criteria and the indicators allowing each supplier to compare their own performance with the best performance, to make the best supplier emerge for each call for proposal.

## **6. Illustration of the supplier evaluation process in a self organized logistic network**

### ***6.1. Selected criteria / indicators***

In the supplier evaluation, an indicator is a piece of information allowing the estimation of a performance with regard to an objective to reach. The indicator of performance is an operational measurement tool that can measure any type of performance, at any level. But, even though the indicator is a promising tool in theory, it is complex in practice. Indeed, it is necessary to formalize the criteria allowing the estimation of the performance of each potential supplier. All the indicators selected are used in the composition of five criteria: cost, delay, quality, reliability and strategy. We will present these criteria and the associated indicators.

- **The Cost criterion 'C<sub>1</sub>'**: The objective of this criterion is to ensure delivery at the best price. The cost criterion is decomposed into two indicators: **Cost of order 'I<sub>11</sub>'**, **Cost of order delivery 'I<sub>12</sub>'**. This criterion takes into account the various costs which compose the cost of acquisition of the goods, it is a quantitative criterion.
- **The Delay criterion 'C<sub>2</sub>'**: The objective of this criterion is to ensure that the customer is delivered as quickly as possible. The delay is the time between the expression of a need by the customer and the actual satisfaction of this need. The product or service required is supplied with the quality required and in the quantity required. Immediate availability corresponds to zero delay. This criterion is decomposed into two indicators: **Lead time 'I<sub>21</sub>'**, **Delivery time 'I<sub>22</sub>'**.
- **The Quality criterion 'C<sub>3</sub>'**: This criterion aims to guarantee that the products delivered are of good quality and in accordance with the specifications, i.e. to minimize unquality. These indicators are either quantitative or qualitative and aim at describing the continuity of the service, the compliance with the rules and with the expectations concerning the product. This criterion is decomposed into three indicators: **Rate of conformity 'I<sub>31</sub>'**, **Respect of a referential 'I<sub>32</sub>'**, **Rate of customer satisfaction 'I<sub>33</sub>'**.
- **The reliability criterion 'C<sub>4</sub>'**: The reliability is the ability of any device to carry out a required function, under given conditions, during a given duration. This criterion aims at guaranteeing that the products delivered are reliable. With the help of this criterion it is also possible to evaluate the capacity of the company to meet the deadlines, and for this, an estimation is made of the respect of the delivery times, i.e. of the efficacy of the order management. This criterion is decomposed into two indicators: **Conformity in quantity of the orders 'I<sub>41</sub>'**, **Respect of delivery times 'I<sub>42</sub>'**.
- **The strategic criterion 'C<sub>5</sub>'**: In the evaluation of each supplier's performance qualitative criteria are taken into account, for example the order of preference of the suppliers (for reasons of privileged relationships linking the Customer and the Supplier, and/or for competition reasons,...). The associated indicators are: **Allowance of differed payment 'I<sub>51</sub>'**, **Degree of privilege 'I<sub>52</sub>'**.

We have defined the adequate system of indicators for the application of the multicriteria algorithm based on the AHP method. The application of the multicriteria algorithm gives us the alternative (the call for proposal) for which the supplier is the best. We will present an example allowing to illustrate the use of the AHP method to evaluate the supplier performance in a self organized logistic network.

## 6.2. Example

Let us remind that a call for proposal is emitted by an entity (customer) having informed the data relative to its order (characteristic of the call for proposal, negotiation delay). All the entities (suppliers), from reception of the call for proposal, will study the feasibility of the call for proposal (are they capable to do the call for proposal), then they will self evaluate. So the potential suppliers determine their performance, and negotiate to make the best solution emerge. Such a system allows an autonomous control where the operator becomes a controller more than an operator.

To illustrate the method of evaluation in a self organized logistic network, we have take a game of data concerning the call for proposals and concerning history of the suppliers. We consider two customers, three suppliers and four Call for Proposals (C<sub>Pi</sub>; i=1, 4). The values of I<sub>11</sub>, I<sub>12</sub>, I<sub>21</sub> and I<sub>22</sub> are specific for each call for proposal, whereas indicators, I<sub>31</sub>, I<sub>32</sub>, I<sub>33</sub>, I<sub>41</sub> and I<sub>42</sub> are informed by history relative to each supplier, their values are thus the same for all the call for proposals. Indicators I<sub>51</sub> and I<sub>52</sub> are informed by the customer for each supplier.

Above all calculation, it is necessary that each supplier fills the matrices of preferences

(criteria and indicators). Indeed, the AHP algorithm needs these data. Each supplier backs up his data. We present the data concerning the matrices of preferences (Cf. Table 2). It concerns the first step of the AHP method. For our example we chose to make equal the relative importance between the Delay, the Cost and the Quality. The Reliability and the Strategy being less important than these three last ones, we thus took into account it in the completion of matrices.

***PLACE TABLE 2 HERE***

Each supplier also has to complete the preferences matrices between indicators in the same way the criteria matrices were complete. We can, from these matrices and from all the data contained in the call for proposals, launch the AHP method which gives us the classification of the call for proposals in negotiation (Cf. Figure 6).

***PLACE FIGURE 6 HERE***

The performance of the call for proposal classified as the first one in the preferences vector of each supplier will allow it to answer only if the supplier is the best with regard to the answer which circulates on the network. The associated performance to this kind of call for proposals allows to assign call for proposal by emergence to the various suppliers participating in the negotiation within a self organized logistic network.

The first supplier who answers is considered as the most successful until the other one emits a best answer. In our example the supplier S3 answers the first on the call for proposal (CP1). The supplier S2 is calculating also its performance, but this one will answer only if he possesses a better performance than the supplier S3, on the call for tender (CP1). It is the case (Cf. Figure 7). This implies that at the end of the negotiation time, if no other supplier gave a better answer, then the supplier S3 will assigned to itself this call for proposal, as the supplier S1 will assigned to itself the call for proposal (CP4).

***PLACE FIGURE 7 HERE***

The call for proposals (CP2) and (CP3) must be assigned in the same way, before the end of the associated negotiation time. Let us point out that the negotiation process is launched for each reception and/or assignment of a call for proposal. Naturally, the other calls for proposals can appear on the network at any moment. The suppliers will repeat their calculation, namely the classification of calls for proposals as well as calculation of the performance associated to the call for proposal placed at the first position in the classification.

## **7. Conclusion**

If we want to see the optimization of the logistic network be efficiently implemented, a change in mentality and philosophy is needed: getting together to propose a global service, not trying to compete on selling prices but on the contrary on manufacturing costs, seeking together what is needed for better productivity. The new ways of supplying / subcontracting need a better dialogue. This cultural evolution is based on cooperation and not on confrontation.

We have proposed to integrate all the suppliers in a partner network that we call "self organized logistic network". We have proposed a methodology for the evaluation of suppliers in a self organized logistic network. Indeed, it is obvious that a whole methodology is needed upstream of the indicators to guarantee their relevance, as well as downstream to exploit

successfully the observations they have made possible. The dashboard is therefore the focal point of a system. It allows analysis and interpretation of the knowledge that we can have of the reality of the company that will help to determine the elements that are useful for the choice of relevant indicators and for the construction of the dashboard which allows their visualization. The decision-making by emergence of the "best" supplier is based on several selection criteria. We have therefore recommended exploiting the multicriteria decision aid method to reach a satisfactory solution. Among the several methods available we have chosen AHP. We have thus suggested in this paper quantifying a local evaluation of each potential supplier responding to the call for proposal emitted by the customer, according to rules and criteria that are impartial and common to all. We have also presented the process enabling the emergence of the "best" supplier. The proposed approach allows to obtain a balance between load/capacity at the supplier level and to obtain smoothing of the load curve among the various suppliers with a long-term objective of proposing a fair system between the suppliers of the network. The proposed approach allows assigning the call for proposal to the best supplier making a sharing of the earnings, by optimizing the resources, by decreasing the dysfunctions and by participating in the increase of the productivity on the whole supply chain from the supplier to the customer.

Our initial objective was to improve the customer-supplier relationship by proposing decentralization [43] of the control system of this relationship belonging to a self organized logistic network. Thus, we have discussed in this paper the proposed organization called "self organized logistic network". The decentralized approach of the decision-making mechanisms that we are working about is based on the increasing autonomy of the actors of a production system and on their capacity to communicate with the other actors for a better reactivity. The concept of self organization<sup>6</sup> depends on the use of a decentralized decision structure as well as on the taking into consideration of the behavior of each of the actors (decision centers).

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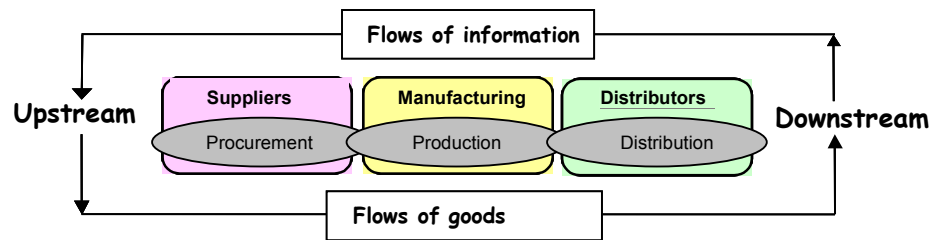
<sup>6</sup> We find several definitions from different origins in [43].

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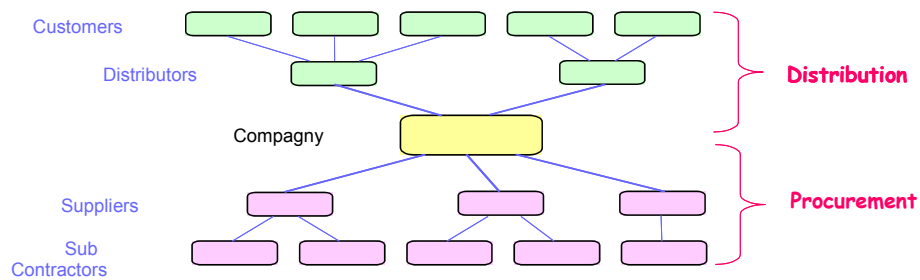
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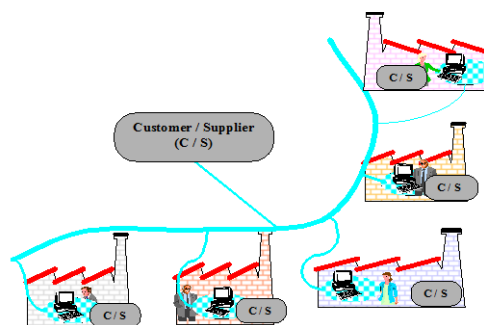
## 9. List of figures and tables



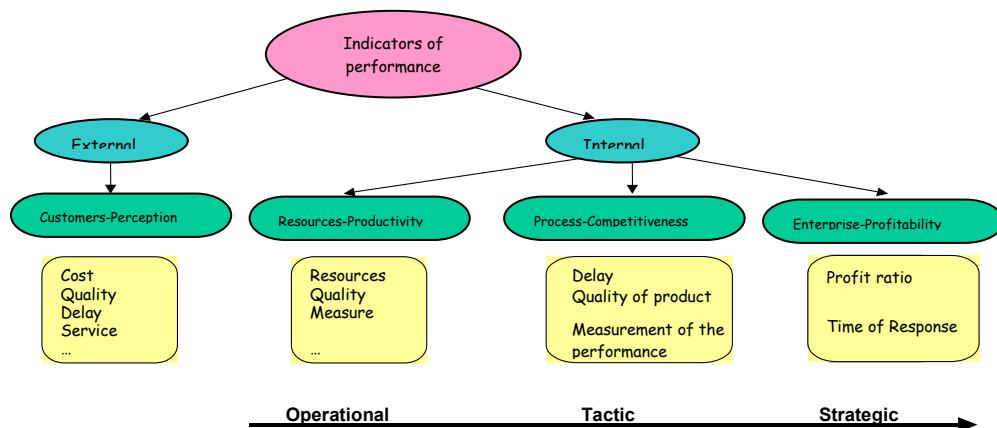
**Figure 1**  
**Representation of a Supply Chain**



**Figure 2**  
**Representation of a Network**

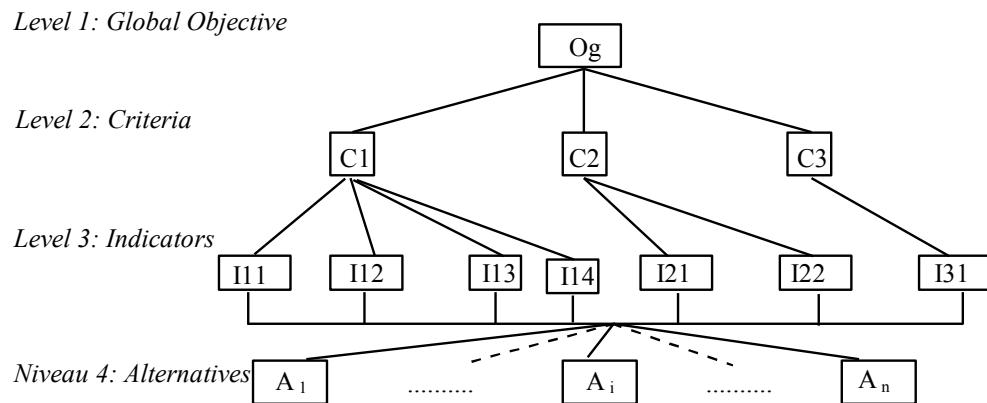


**Figure 3**  
**Self organized logistic network**



**Figure 4**

### Organization of a performance indicator



**Figure 5**

### Example hierarchical process of decision-making

Numerical Values	Definition
1	Equally important
3	Slightly more important
5	Strongly more important
7	Very strongly more important
9	Extremely more important
Reciprocals	Used to reflect dominance of the second alternative as compared with the first.

**Table 1**

### Scale of Measurement for AHP [Saaty 1980]

	Delay	Cost	Quality	Reliability	Strategy
Delay	1	1	1	3	5
Cost	1	1	1	3	7
Quality	1	1	1	3	7
Reliability	1/3	1/3	1/3	1	5
Strategy	1/5	1/7	1/7	1/5	1

	I 11	I 12
I 11	1	3
I 12	1/3	1

	I 21	I 22
I 21	1	3
I 22	1/3	1

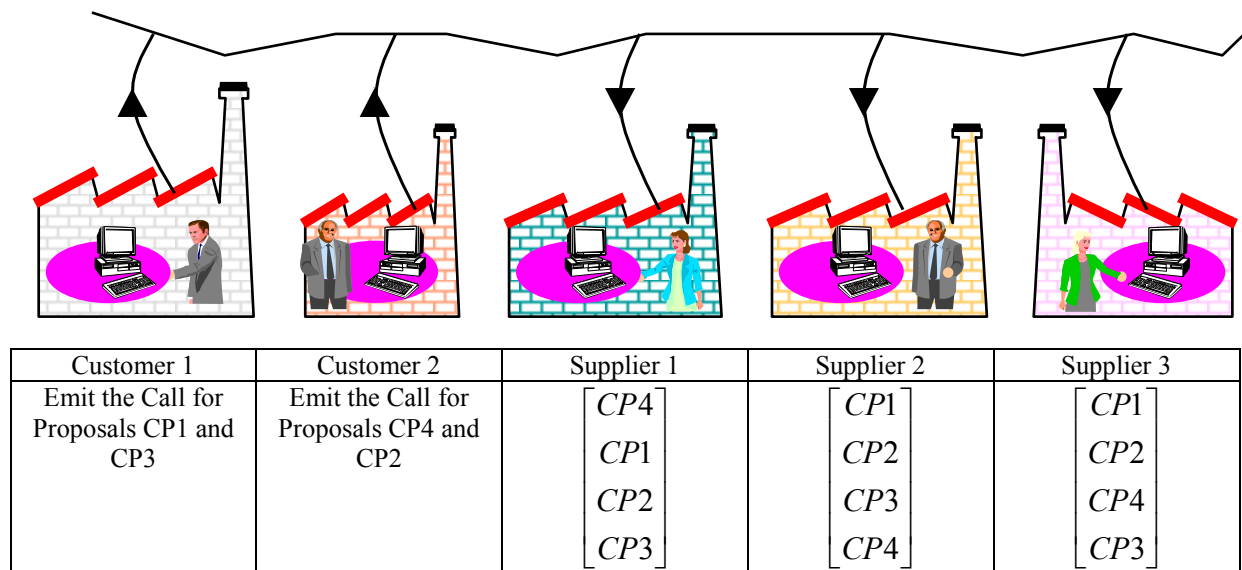
	I 31	I 32	I 33
I 31	1	5	5
I 32	1/5	1	1/3
I 33	1/5	3	1

	I 41	I 42
I 41	1	1/3
I 42	3	1

	I 51	I 52
I 51	1	1/5
I 52	5	1

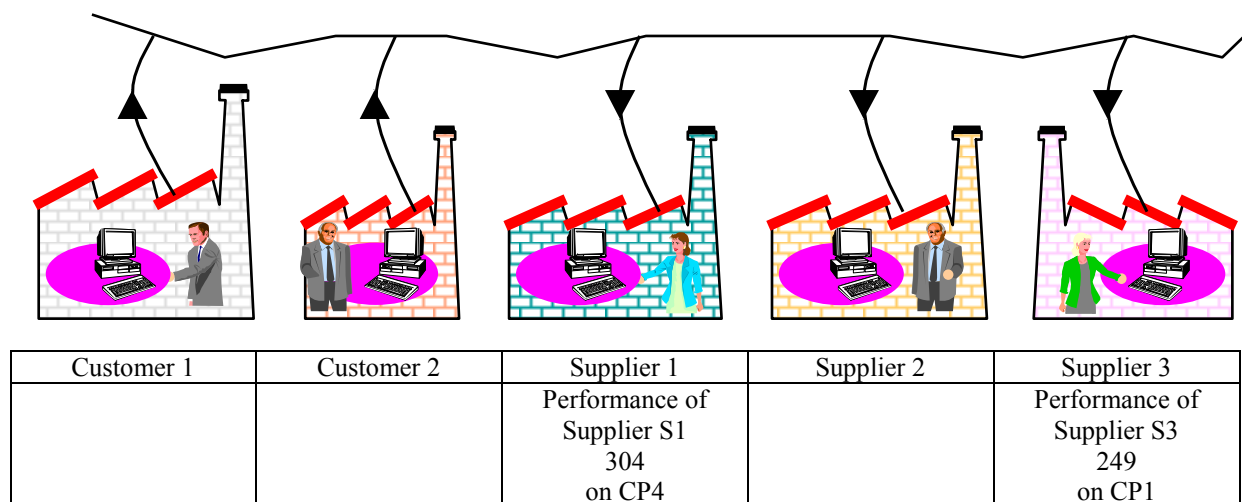
**Table 2**

### Relative importance's matrices



**Figure 6**

*Classification of call for proposals (CPs)*



**Figure 7**

*Assignment of CP1 and CP4*